**United States Patent Application**

**for**

# A VEHICLE MOUNTED LOW VOLUME CLEANING SOLUTION SYSTEM

**TO THE COMMISSIONER OF PATENTS AND TRADEMARKS:**

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**Field of the Invention:**

The invention generally relates to a vehicle mounted low volume cleaning solution system for textiles, like carpets and drapes, which minimizes the use of typically environmentally damaging textile cleaning solutions.

**Background of the Invention:**

Numerous truck mounted water pump pressure washing systems have been suggested in the prior art. Each of the following prior art patents are herein incorporated by reference for their supporting teachings of the present invention:

U.S. patent no. 5,165,139 related to a self contained mobile cleaning unit for cleaning carpets, high pressure washing, and for recovering various liquids, such as spillages or floods.

U.S. patent no. 4,109,340 teaches a carpet cleaning machine mounted on a truck or van for transport to the work site. The main power for the machine is developed by an internal combustion engine that drives an injection pump, a vacuum pump, and a sump pump. A reservoir maintains and stores a supply of cooling water and cleaning fluid for removing heat generated by the engine. Coolant fluid is drawn from the engine by the injection pump for transmission to the carpet cleaning injection nozzles. The coolant may be further heated as it is drawn from the engine by means of a heat exchanger that removes heat from the engine exhaust gases.

U.S. patent no. 5,469,598 is an apparatus for producing heated water, including steam, to be used as a cleaning fluid, includes an internal combustion engine, a water heating assembly, a vacuum generating device, a cleaning assembly and a dirty water collector. The heating assembly includes piping and three heat exchangers. Two of the heat exchangers are located to receive exhaust gas directly from exhaust ports respectively of the engine. The third heat exchanger receives a mixture of gas that includes residual exhaust gases from the first and second heat exchangers and the

output of the vacuum generator. Water is preheated in the third heat exchanger and finally heated in the first and second heat exchangers. The heated water is used at the cleaning assembly and partially reclaimed by the vacuum generator. Condensed water and dirt are collected in the collector and water vapor is further heated by and passed through the vacuum generator to the third heat exchanger.

U.S. patent no. 5,606,768 teaches an emissions collection and venting system for a van-mounted or mountable cleaning system as disclosed, and includes a water heater having a burner therein to heat the water and a flue outlet to release combustion gases therefrom. A motor driven vacuum blower has an air input port and an output port for blower exhaust, both the water heater and the vacuum blower being mounted or mountable in an interior portion of the van body.

U.S. patent no 5,871,152 teaches a remote controlled carpet cleaner that includes a rectangular outer support frame of structural steel. A gasoline engine drives a vacuum pump and through a pulley and belt assembly it also powers a liquid pump. The exhaust gas from the engine is directed to a heat exchanger that is used to heat water that is pumped through the heat exchanger by the liquid pump. A liquid injector allows carpet cleaning chemicals to be mixed with the water as it enters the pump. The liquid injector is connected to a plurality of solenoid valves. Each solenoid valve is connected to a tank containing a carpet cleaning chemical. When a solenoid valve is opened, a specific carpet cleaning chemical is drawn into the liquid injector and mixed with the water entering the pump. The opening and closing of the solenoid valves is controlled by servo motors operated by a radio controlled receiver. The remote controlled carpet cleaner offers a substantial increase in productivity by offering an operator the ability to remotely control and dispense required cleaning chemicals without making repeated trips between the cleaning site and a supply truck.

## PROBLEMS WITH THE PRIOR ART

Prior art truck mount systems, like the major service providers of Stanley Steamers® or Service Master®, have one common troublesome feature; namely, these textile cleaning systems are steam or water based systems that first apply and then extract large quantities of their liquid cleaning solutions. In fact, the collecting of the large quantities of extracted dirty cleaning solution was one reason for developing truck mounted cleaning systems in the first place, since it takes a truck to hold all of the extracted dirty cleaning solution.

A problem has developed with using carpet cleaning solutions due to new governmental regulations. Governmental agencies have classified many of these textile cleaning solutions as being detrimental to the environment. Therefore, regulations have been implemented that detail how to legally process the extracted dirty cleaning solution. For example, used cleaning solution may need to be temporarily stored in the truck, instead of dumping the used solution down the storm drains, as in the past. The used and stored cleaning solution then needs to be transported to a designated government regulated dump site to prevent ground water contamination and other undesirable environmental repercussions. Additionally, to use the governmentally regulated dumping stations government fees are required, which can be a burden to most cost sensitive cleaning businesses. Therefore, it is not in the interest of the environment or the business owner to utilize a large amount of cleaning solution or water in or part of the cleaning solution.

A typical commercial cleaning system, for example, cleans only about 33 to 38 square feet of surface area per gallon of cleaning solution. Assuming that an average carpet cleaning project is 500 square feet, it would require between 13 to 15 gallons per job. This means that a large 30 gallon extraction solution tank will be needed to be mounted in the truck for a commercial cleaning system to complete only 2 average cleaning projects. Assuming that an average 500 square foot project takes between one to three hours; the 30 gallon tank should be emptied every two to six hours of cleaning. This constant emptying of the 30 gallon storage solution tank will affect the profitability of a carpet cleaning business.

In addition to the constant emptying of the extraction storage solution tank, there are resulting problems with using large amounts of water based cleaning solutions. It is common knowledge that it takes, on average, 8 to 24 hours to dry the carpets sufficiently before being able to replace the moved furniture back onto the cleaned carpet. This time period is typically needed so that the remaining moisture does not damage the furniture. However, recent research has discovered that during the 12 to 48 hour drying time, some molds and mildews have been discovered growing in the carpet as a result of the significant moisture content in the carpet. In fact, some of these molds, like black mold, and mildews are suspected of causing human illnesses, and even respiratory problems. A further problem with having large quantities of standing moisture on a carpet is that the existing moisture, or cleaning solution, has been found to actually cause stains and dirt, which were buried in the lower portions of the carpet, to actually wick up to the top of the carpet fibers during the drying time.

Finally, due to the large volume of cleaning solution needed for the current truck mounted cleaning systems, an exterior water source is typically hooked up to the truck mounted system at the customers location. A problem occurs because there has been a significant rise in the costs for water usage in many communities. Thus, the customer ends up with an unexpected higher water bill from supplying the water to many current truck mount systems. A closely aligned problem exists during winter seasons. Specifically, customers often have their exterior hose connections turned off during cold seasons, which would prevent the carpet cleaner from even using the customers' typical water hookups.

Therefore, there is a need for a truck mountable textile cleaning system that: 1) uses less water or cleaning solution than the typical existing truck mounted cleaning systems to clean the same amount of area; 2) requires a smaller amount of environmentally damaging water-based cleaning solution so that fewer trips to governmentally regulated dump sites are needed; and 3) has a self contained water-based cleaning solution that does not have to be connected to a customers water supply during operation.

These and other problems are solved by the currently illustrated invention. Other solutions that solve the currently illustrated invention will become apparent to one skilled in the relevant art after review of the specification, drawings and appended claims.

## SUMMARY OF THE ILLUSTRATED EMBODIMENT(S)

The present invention involves a vehicle mounted low solution use textile cleaning system. Uniquely, the present invention provides for a truck mountable textile cleaning system that: 1) uses less water or water-based cleaning solution than the typical existing truck mounted cleaning systems to clean the same amount of area; 2) requires a smaller amount of environmentally damaging water-based cleaning solutions so that fewer trips to dump sites are needed for the same amount of cleaning; and 3) has a self contained water-based cleaning solution that does not have to be connected to a customers expensive water supply during operation.

Another feature of the present invention is to provide a vehicle that may be adapted to implement application of a cleaning solution to a remote textile area to be cleaned. Specifically, the vehicle comprises a storage system, positioned in the vehicle, and designed to hold the cleaning solution. Additionally, there may be a delivery system fluidly coupled to the storage system to enable delivery of the cleaning solution to the textile area to be cleaned. There may also be an effluent storage system, positioned in the vehicle, and designed to hold dirty cleaning solution that has been extracted from the textile area.

Another potential feature of the illustrated embodiment may be to provide a mixing chamber, coupled to mix the cleaning solution before application to the textile area. Another embodiment could also include a heating system, positioned in the vehicle, and coupled to receive the cleaning solution from the mixing chamber. There may also be an embodiment that has the delivery system comprising of a cleaning applicator, coupled to receive and then apply the heated cleaning solution to the textile area to be cleaned. The vehicle may further comprise a cleaning solution vacuum

system, associated with the cleaning applicator, and designed to remove the applied heated cleaning solution from the textile area and deposit the dirty cleaning solution into the effluent storage system. The vehicle additionally may further have a cleaning solution air compressor system designed to move the cleaning solution from storage system, through the delivery system and to the effluent storage system. Yet another feature of the vehicle may have the cleaning solution that may be a carbonated cleaning solution employing mixture of an acidic and basic solution that effervesces upon release from the delivery system and onto the textile area.

Additional features and advantages of the invention will be set forth in the detailed description and claims which follows, taken in conjunction with the accompanying drawings, which together illustrate by way of example, the features of the invention.

## BRIEF DESCRIPTION OF THE DRAWINGS

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the exemplary embodiments illustrated in the drawings, and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended. Any alterations and further modifications of the inventive features illustrated herein, and any additional applications of the principles of the invention as illustrated herein, which would occur to one skilled in the relevant art and having possession of this disclosure, are to be considered within the scope of the invention.
Specifically, there is provided:

Fig. 1 is a plan top view of a sectioned vehicle that illustrates the placement and functional connection of an illustrative embodiment of the invention.

## DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENT

As required, detailed embodiment of the present invention are disclosed herein; however, it is to be understood that the disclosed embodiments are merely exemplary of the invention, which may be embodied in various forms. Therefore, specific structural and functional details disclosed herein are not to be interpreted as limiting, but merely as a basis for the claims and as a representative basis for teaching one skilled in the art to variously employ the present invention in virtually any appropriately detailed structure.

In Figure 1 there is an illustrated embodiment of a truck mounted cleaning system 10. Specifically, the illustrated embodiment provides a van (also referred to as a truck) 11 that has its roof 12 removed to illustrate features of the invention that are mounted in the storage area. In one embodiment a vehicle engine 14 may be coupled to a cleaning solution power and control system 22 to assist in powering the control system 22. The van 11 is illustrated to have at least two side doors 13, but any number and placement of doors will enable the illustrated invention. A carpet cleaning device or wand 16 is illustrated to be coupled to the vacuum hose 18 and the cleaning solution supply hose 20. The control system 22 has an air compressor 24, a heating system 26, and a vacuum pump 33 associated therewith. There is a vacuum hose storage device 28 that may be coupled to the vacuum hose 18. The vacuum hose 18 may be of any standard length, such as 75 to 300 feet or more. The storage device 28 may be designed for the convenient storage of the large section of hose 18. The hose storage unit 28 has an effluent hose 29 that may be coupled to the effluent waste water reservoir or tank 30. A vacuum hose 31 may be coupled to the vacuum pump 33. The application wand 16, hose 18, storage unit 28, hose 29, tank 30, hose 31 and vacuum pump 33 are all coupled in any standard means that is sufficient to create a known vacuum air pressure for the intended purpose of removing cleaning solution from an application site. An air pressure supply line 32 may be coupled to one or more cleaning solution tanks 34 and 36. The two illustrated tanks 34 and 36 contain the preferred acid and base cleaning solution mixtures, which will be discussed in more detail below.

There may be a mixing chamber 38, coupled in series to each side of the two cleaning solution mixture tanks 34 and 36. An output solution hose 40 is coupled between the chamber 38 and the heater unit 26.

In the illustrated embodiments, the operation of the two solution tanks 34 and 36 generally follows known pressure tank operations that are coupled in series. Specifically, it is contemplated to use an acid solution in one set of tanks 34 and a base solution that would be contained in the other set of tanks 36. The different acid and base solutions are forced into the mixing chamber 38 via air pressure. The mixing chamber 38 receives the pressurized solutions and mixes them together to form a preferred carbonated cleaning solution. Specifically, the particular acid and base cleaning solutions and preferred resulting carbonated cleaning solution, and methods of making the carbonated cleaning solutions that may be used are taught by U.S. patent nos. 4,219,333, 5,244,468, 5,593,091, 5,624,465 and 5,718,729, which are each herein incorporated by reference into the current specification for their respective supporting teachings. It is noted that the term "cleaning solution" as used in the present application refers directly to the teachings of these listed patents, which in turn refer specifically to a carbonated cleaning solution.

For the continued understanding of the operation of the illustrated invention, it is particularly noted that pressure upstream from the mixing chamber 38 is much higher (for example, it could range from about 80 to120 psi (pounds per square inch)) than the pressure found after the mixing chamber 38 (for example, from about 10 to 25 psi). In the illustrated embodiment, the mixed cleaning solution in the line 40 is routed to a heating unit 26 where the solution is elevated to the desired cleaning temperatures. The heated cleaning solution is then routed through the subsequent hose 20 to the application cleaning wand 16 where it is gently applied under low pressure to the application area, like a carpet. It is at the application time and contact with the air upon making contact with the application area that the carbonated carpet cleaning solution undergoes an effervescent or bubbling action that assists in the removal of the dirt from the carpet.

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The last step in this illustrated operation is to use the vacuuming system to remove the effervescent cleaning solution from the application area. The operation of the vacuum system uses a vacuum pump 33 that pulls air through the hose 31 to create a vacuum in the tank 30. The tank 30 vacuum creates a resultant vacuum in the subsequent hose 29 and thereby through the next hose 18 and finally down to the cleaning applicator or wand 16. Thereby, the vacuumed cleaning solution will be sucked into, and held, in the storage tank 30.

## COMMENTS REGARDING THE ILLUSTRATED EMBODIMENTS

It is noted that the low pressure operation (i.e. about 10 to 25 psi) of the application cleaning solution enables the current invention to provide low volumes of the cleaning solution during cleaning operations. Another reason for the low solution volumes is that the cleaning solution utilizes a carbonated action that aids in the lifting out of the dirt from the carpet fibers, and does not rely on a large volume of solution, like the prior art, to aid in the removal of dirt from textiles.

It is also noted that the current system uses an air pressure pump 34. In the typical prior art systems, which need large volumes of cleaning solution, it would be impossible to use an air pump system. An air pump system could not practically handle the amount of liquid needed for proper operation of those systems. Conversely, it is because of the low volumes of cleaning solution required for proper operation of the illustrated embodiments that an air pressure pump can be used in the present embodiment. One advantage in using air pressure pumps is that they do not come into physical contact with the working solutions like liquid pumps do. It has recently been identified that this contact with water pumps eventually corrode or deteriorate the liquid pump when using corrosive solutions, like the basic and acidic solutions described in the illustrated embodiment. Therefore, the air pump is superior in that there is no direct contact with the pump components. Additionally, an air pump provides for a steadier and equal flow rate between the two separate paths for the two solutions. This even

matching of flows avoids uneven mixture of solutions in the mixing chamber 38, thus having accurate effervescent cleaning solution mixtures for proper cleaning. When testing the current illustrated embodiment, the following results were achieved under the following listed conditions. Using approximately a 3/16 inch inside diameter cleaning solution hose and having a length of 150 feet, a flow rate of about 0.44 gallons per minute was achieved, as compared to the larger typical 1.8 gallons per minute flow rate for typical prior art designs. That is a 409% decrease in flow rate over the prior art. Therefore, one embodiment of the present invention is to provide a remote cleaning vehicle that can supply a flow rate of cleaning solution that is less than 1.5 gallons per minute, and preferably less than 0.5 gallons per minute. Thus, with those flow rates, the illustrated invention would prevent large quantities of dirty cleaning solution for a given amount of cleaning time.

The illustrated embodiment was also able to achieve a cleaning rate of 130 to 150 square feet of carpet per gallon of cleaning solution, whereas the prior art cleaning systems were only able to achieve 33 to 38 square feet of cleaned carpet per gallon of their cleaning solution. That is a 394% increase of cleaning area per gallon of cleaning solution. Therefore, another embodiment of the present invention is to provide a vehicle mounted cleaning system that provides a cleaning rate of at least 50 square feet, and preferably over 100 feet, of cleaned carpet per gallon of cleaning solutions.

Finally, based on an average carpet size of 500 square feet, only about 3.3 to 3.8 gallons of cleaning solution was required to clean that area, whereas the prior art cleaning solutions had to use 13 to 15 gallons of solution to clean that same size area. Again that is a 394% decrease in the amount of cleaning solution used to clean a typical 500 square foot area. Therefore, another embodiment of the present invention is to provide a vehicle mounted cleaning system that uses 10 gallons or less, and preferably less than 4 gallons, of cleaning solution for a 500 square feet textile area.

As a result of these previous calculations, and assuming that there is a 30 gallon tank for the used cleaning solution, the current invention would be able to clean from 7.9 to 9.1 cleaning jobs before having to empty the storage tank 30. Whereas, the prior art

systems may be only able to clean 2 to 2.3 similar jobs before having to empty the same storage tank. That amounts to about 400% to 500% more jobs to be completed before having to empty the 30 gallon tank.

## VARIATIONS OF THE ILLUSTRATED INVENTION

It is understood that the above-described arrangements are only illustrative of the application of the basic principles of the present invention. Numerous modifications and alternative arrangements may be devised by those skilled in the art without departing from the spirit and scope of the present invention. The appended claims are intended to cover such modifications and arrangements.

For example, it is noted that there is no requirement for there to be two side doors 13 to the van 11. Any number of doors will be sufficient. Moreover, the location of the cleaning engine 22 is variable. Specifically, the cleaning engine could be located at the rear of a van that has a rear door design. Similarly, the hose mounting unit 28, the reservoir 30, and the tanks 34 and 36 could also be repositioned most anywhere in the van 11. Additionally, hose storage unit 28 could be most any form of a known hose storing device. For example, it could be a unit that rolls up the extended hose, and is powered by a motor of some type. Although it is discussed to use a acid and base cleaning system, it is contemplated to use any cleaning solution that allows for low volumes of cleaning solution that would allow for air pressure delivery based system. In yet another variation, it is contemplated to use any form of an air delivery based system, such as a compressed air tank having no constant refilling means. Moreover, it is illustrated to use four cleaning solution storage tanks 34 and 36, it is contemplated however to have any number of tanks sufficient to accomplish cleaning operation. Additionally, the use of the word textile or material is intended to illustrate a broad classification of objects that may to be cleaned using the illustrated invention. For example, textile could mean carpets, drapes, furniture material, rugs, clothes, bed spreads, mattresses, wall coverings, etc.

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